BEFORE THE

# Federal Communications Commission

WASHINGTON, D.C. 20554

| | | |
|---|---|---|
| In the Matter of | ) | |
| | ) | |
| Amendment of Parts 5, 21, 22, 23, 25, 73, 74, | ) | RM-8165 |
| 78, 80, 87, 90, 94, 95 and 97 of the Rules to | ) | |
| Establish a Radio Astronomy Communications | ) | |
| Zone in Puerto Rico | ) | |

To: The Chief, Policy and Rules Division

## REPLY TO COMMENTS

Cornell University ("Cornell"), by its attorney, pursuant to §1.405(b) of the Commission's Rules, hereby replies to the Comments filed by the Society of Broadcast Engineers, Inc. ("SBE"), the American Radio Relay League, Incorporated ("ARRL"), and by Radio Aeropuerto, Inc., WAEL, Inc., Abacoa Radio Corp. and South Puerto Rico Broadcasting Corp. ("Stations"), all of which responded to the Petition for Rulemaking filed by Cornell seeking to establish a radio astronomy communication zone in Puerto Rico.

I. Cornell desires to preserve the Scientific Future of Arecibo Observatory

1. The federally funded Gregorian Upgrade described in Cornell's Petition is a major program to improve and extend the useful life of the Observatory into the far future, such that future generations may be able to conduct research with this unique instrument. Cornell is pleased and encouraged by the recognition and positive support given to the Observatory's important role in national research by each of the three Comments cited above. [1] Arecibo and the Green Bank Telescope ("GBT") are the two major and complementary telescopes in the U.S., which are now under construction and undergoing major upgrading. Arecibo is and will be much more sensitive than the other telescope, the 100-meter diameter Green Bank Telescope ("GBT"). The Arecibo telescope with the Gregorian subreflector system is able to operate up to 15 GHz, while

[1] SBE Comments at p. 1; ARRL Comments a p. 2; Stations Comments at p. 7.

the smaller GBT is designed to operated to 50 GHz and eventually 120 GHz. The Arecibo sensitivity is unique in the world, and irreplaceable in American radio astronomy.

2. Cornell is asking the Commission to recognize the existence of the Arecibo Observatory and its special requirements in terms of RFI management. The Observatory has not enjoyed any special status before the Commission in its thirty year existence. However, efficient spectrum management is becoming evermore essential. At this time of substantial improvements to the Observatory through the Gregorian Upgrade Program, the time is appropriate for the Commission to help secure the future of the Observatory.

3. The ARRL and the especially the Stations indicate that notification of the Observatory about intended new applications or modifications of existing services may be burdensome for the other spectrum users, [2] and that "protracted, unnecessary and expensive" engineering studies would be required for the applicants. This is not the intent of Cornell's Petition, nor would it be the result if the proposed rules are adopted. Notification by copy of the FCC application is satisfactory to Cornell, although earlier coordination would be welcomed.[3] Propagation and PFD calculations using standard industry-recognized procedures may be carried out at the Observatory at no cost to the applicant. In compliance with the National Environmental Policy Act of 1969, the FCC has implemented rules requiring applicants to address environmental considerations. Section 1.1301 et seq. of the FCC's Rules. The Puerto Rico Planning Board is also very concerned with a variety of environmental issues in this densely populated island and the radiation environment is one of the issues that have received considerable attention. To require applicants to consider radiation exposure to Arecibo Observatory is analogous to, and no more burdensome than, assessing the environmental impact under the present FCC rules. Preserving a national resource is not too much to ask from the broadcasting industry.

## II. Arecibo is more Vigilant about Spectrum Management

4. The Gregorian system at Arecibo Observatory will open new research opportunities and will undoubtedly facilitate exciting discoveries in the various fields of research. The Petition has emphasized that the Gregorian will make the whole spectrum from below 300 MHz to about 15 GHz accessible for research. That includes many

---

[2] ARRL Comments at p. 3; Stations Comments at p. 2. SBE characterizes the notification requirement as "not, on its face, unreasonably burdensome." SBE Comments at p. 4.

[3] Earlier notification will facilitate informal, good faith efforts to resolve anticipated interference and should, if successful, obviate the need to file a formal objection. It would only be necessary to codify this effort, as suggested by SBE at p. 4 of its Comments, if applicants are unwilling to coordinate with the Observatory sufficiently in advance of filing their applications.

spectral bands, where scientists have not worked before. Radio Astronomy Service ("RAS") does not have any status in most of these spectral regions. But scientists will undoubtedly try to do passive experiments there. Opening up new spectral regions for research has made the Arecibo staff acutely aware about the RFI environment. As a result the Arecibo staff must vigilantly monitor new applications at the Commission and provide comments when severe interference would result from certain applications. This type of vigilance on the part of the Observatory can be much more effective for all parties with the establishment of a Radio Communication/Coordination Zone in Puerto Rico. The Communication Zone provides the Observatory and individual applicants the opportunity to communicate and work out possible differences before the application reaches the Commission. This will save money and precious time for the applicants, the Commission and the Observatory. Such advantages and efficiencies will not exist in the absence of a Communication/Coordination Zone.

III. The Puerto Rico Radio Coordination Zone will never be a Quiet Zone

5. Cornell is neither overtly nor covertly attempting to obtain veto power over, or to bind the hands of, other services operating on the island as feared by Stations.[4] Puerto Rico will never become a Quiet Zone as it has been called in some of the Comments. It is impossible to turn time backwards. The Cornell Petition is merely attempting to deal with future changes to the RFI environment in an efficient manner. The Observatory has always tried to coexist with the other services and these objectives will not change in the future. Arecibo Observatory is an active member of the newly established Puerto Rico Spectrum Users Group, which is open to all spectrum users on the island. Coordination and information sharing schemes have been established for years between the Observatory and the Naval Area coordinator at Roosevelt Roads, the Puerto Rico national Guard, the Drug Enforcement Agency, the Federal Aviation Administration, the two cellular phone services, as well as the individual broadcasters. Recently the Observatory became a member of the Puerto Rico Broadcasters Association. Therefore, the term "quiet" should at no time be associated with the requested Communications Zone. When the Commission deems it right to establish a Communications Zone to benefit the Observatory, a more appropriate name would be the Puerto Rico Radio Coordination Zone.

IV. Locating the Observatory in Puerto Rico was a well Balanced Decision

6. The choice of the location for the Arecibo Observatory has been based on four important considerations. First, the telescope must be located near the equator in order to

---

[4] Stations Comments at p. 6.

obtain optimum exposure to crucial atmospheric/ionospheric phenomena. Similarly, observations of planets in our Solar System require a location close to the Earth Equator. Furthermore, sky coverage for an upward looking telescope is the largest for a location near the equator. Because of its location, the Observatory can observe a large fraction of the celestial sky. Second, the geology of the area must facilitate the building of a single spherical telescope with a surface area of 20 acres. Such terrain exists at only three locations near the equator: in central Africa, in Central America, and in Puerto Rico. Third, because the Observatory needed to be at a remote site, a politically stable environment was required. Fourth, a quiet site was needed. The karst region close to Arecibo was chosen in 1958 for sound scientific and management reasons. The success of the Observatory as a unique research instrument has proven the validity of that decision over the years, and has led to repeated reinvestment to improve its capabilities.

7. The curious allegation made by the Stations about locating the Observatory in the midst of all these broadcasters[5] is in conflict with reality. When the Observatory was built in the early sixties, Puerto Rico was a rather quiet broadcasting region.[6] The boom in broadcast services started much later. The Observatory was there before many recent services moved into the area. These include cellular phone, microwave link operations most radio and TV stations.[7] During the last thirty years the other spectrum users have been free to operate within the FCC rules, while giving little consideration to the needs of the Observatory. With the present Petition Cornell request the Commission to take into account the Observatory as a unique scientific asset, and to ensure that future growth in spectrum usage is managed efficiently and well for all spectrum users.

8. Moving the Observatory to a quieter location as suggested by the Stations seems a rather unrealistic option. Of the possible locations close to the equator listed above, Puerto Rico remains by far the best. In any event, to replace the Observatory now would cost $150 million, an expense which neither Cornell nor the radio astronomy community could afford. An offer to fund a move of this magnitude has not been extended by the Stations either.

## V. The Reality of RFI at the Observatory

9. The Comments from SBE question the reality of interference at the Observatory in other bands than the neutral hydrogen band discussed in the technical

---

[5] Stations Comments at pp. 3-4.

[6] According to the 1960 Broadcasting Yearbook, there were only nine operating television stations, 34 AM stations and six FM stations in Puerto Rico.

[7] As Cornell stated in its Petition (at p. 2), as of 1992 there were 117 radio stations, 34 full service television stations and eight LPTV station in Puerto Rico, plus uncounted other stations in other services.

statement in the Petition.[8] The message presented in the Petition is that of general concern across much of the spectrum up to at least 3 GHz. RFI is an everyday occurrence even in bands allocated to the RAS. Outside those bands, in many parts of the spectrum, the passive use of the spectrum for radio astronomy observations is extremely difficult. The Observatory can certainly document the general picture of spectrum use in Puerto Rico. The Observatory staff has informed a number of stations at various instances about their faulty equipment as deduced from strong harmonic emissions in the RAS bands. The Petition clearly discussed the RFI threat for the Observatory and there should be no question about its present and future reality. The Cornell Petition concentrates on the expected increase in sensitivity of the telescope and the advances in receiver technology in its assessment of the RFI threat.

10. SBE has also addressed the issue of terrain shielding for the Observatory.[9] The Cornell Petition states on page 2 and 3 that:

> Because of the rugged local terrain, many stations locate their transmitters on higher elevations in order to provide usable island service. The Arecibo Observatory enjoys very little natural shielding for radiation sources over a large fraction of the island because its observatory platform, located on high terrain, is further significantly elevated and is thus vulnerable to signals coming across the horizon.

In this context the terrain studies presented by SBE are misleading because the terrain shielding has been displayed towards sea level in a number of coastal cities. However, as stated in the Petition, powerful transmitters are located at high elevations and will not be at the beach in Mayaguez or Fajardo. Similarly, Ponce stations are commonly located at peaks in the Cordillera Central, the central mountain range running east to west. As result, many of the actual transmission sites are unshielded or only partially shielded. The Observatory estimates that more than 65 percent of the area of Puerto Rico is unshielded and this area contains a very large fraction of all transmitters.

11. In order to illustrate this issue, the terrain shielding has been determined for the Observatory with respect to actual transmitter locations of assigned stations of the same four cities used as examples in the Comments of SBE. Attached Figures 1A-E clearly show the very limited terrain shielding for the Observatory. This conclusion is completely contrary to that of SBE.

---

[8] SBE Comments at p. 5. See also Stations Comments at pp. 4-5.
[9] SBE Comments at pp. 2-3.

## VI. Short Term Operations

12. Cornell does not intend to preclude short term temporary operations in Puerto Rico, as defined by Section 74.24 of the Rules.[10] Cornell understands that circumstances may not allow prior coordination. However, Cornell would request that notification be made to the Observatory prior to commencing operation so that the operation of the Observatory can be modified as necessary if there is a potential for interference to the Observatory. This notification may prevent scientists from traveling a great distance and using the telescope's limited resources to observe if interference to those observations might occur. Cornell now proposes that the prior approval of the Observatory should be required only for applicants seeking short term authority within the 4-mile (6.4 kilometer) radius Commonwealth of Puerto Rico Protection Zone, except in cases of extreme emergency. Personnel are on duty at the Observatory 24 hours a day to answer the telephone and take the necessary information regarding such an operation. A fax number is provided below for convenience.

13. Therefore, Cornell retracts its proposal to modify Part 74.24(i) of Title 47 of the Code of Federal Regulations as advanced in the Petition for Rulemaking. Instead, Cornell now proposes that Part 74 of Title 47 of the Code of Federal Regulations be amended to include a new subsection as follows:

> Section 74.24(j), Notification to the Arecibo Observatory, is added to Part 74 to read as follows:
>
> (j) Notification to the Arecibo Observatory. - Prior to commencing short term operation of a remote control pickup broadcast station, a remote pickup automatic relay station, an aural broadcast STL station, an aural broadcast intercity relay station, a TV STL station, a TV intercity relay station, or a TV translator relay station within the 4-mile (6.4 kilometer) radius Commonwealth of Puerto Rico Protection Zone (Centered on NAD27 Geographical Coordinates North Latitude 18° 20' 45", West Longitude 66° 45' 12"), approval must be obtained from the Arecibo Observatory. Operations within the Puerto Rico Communications Zone but outside this Protection Zone, shall provide notification to the Arecibo Observatory prior to commencing operation. Notification should be directed to the following:
>
> Interference Office
> Arecibo Observatory
> Post Office Box 995
> Arecibo, Puerto Rico 00613
> Tel. (809) 878-2612
> Fax (809) 878-1861

---

[10] SBE Comments at pp. 6-8; Stations Comments at pp. 5-6. See also ARRL Comments at pp. 5-6.

## VII. 18 and 23 GHz Stations

14. The frequency range for the Observatory in the near future with the Gregorian will indeed only run to 15 GHz. Links at 18 and 23 GHz will thus not presently affect operations at the Observatory.[11] However, the possibility of future upgrades to higher frequencies for the telescope renders it prudent for the Arecibo staff to also monitor applications at those frequencies and especially those bands, which show a potential for growing use in the future. New applications for such services may not arouse any opposition from the Observatory but a reporting scheme for all applications including these would be beneficial for all parties.

## VIII. Amateur Services

15. The Observatory has a number of highly skilled amateur operators on its staff and is very understanding of the needs and interests of the amateur community. The Observatory recognizes that the amateurs provide an extremely important service with their emergency network. In fact, during and after hurricane Hugo, the Observatory could only communicate with the outside world through the amateur service. Conflicts have always been amicably resolved through personal contacts and the Observatory will not let anything stand in the way of such a beneficial relationship. The Observatory considers the amateurs indeed as an ally and new efforts have been undertaken to further strengthen this relationship. The Observatory does not feel that mentioning the Observatory in section 97 at the same locations as for the other coordination zones would jeopardize amateur operations significantly.[12] All existing service will be grandfathered and most of the amateur applications will not draw any objection from the Observatory. It is not Cornell's intent to require notification in those instances when the FCC does not require notification. Sending a copy of the application to the Observatory is only a small burden for the amateurs. Modification of section 97 can only reinforce the necessity of the cooperative relation between the Observatory and the amateurs.

## IX. Standards for Measuring Interference at the Observatory

16. The SBE raises the question of standards for evaluation of the interference potential for certain applications.[13] It is important to note that the damage RFI can do to astronomical data is not uniform. It depends critically on the strength of the signal but more on where it falls in the spectrum. For example, out of band emissions falling within

---

[11] See SBE Comments at pp. 8-9. The Observatory may object to running such a high frequency link across or near the 4-mile radius Protection Zone established by the government of Puerto Rico.

[12] See ARRL Comments at pp. 4-7.

[13] SBE Comments at pp. 5-6. See also ARRL Comments at pp. 3-4 and Stations Comments at p. 5. Cornell rejects SBE's proposal to require Cornell to bear the expense of installing additional filtering. Any expense incurred by an applicant seeking a license should be borne by the applicant.

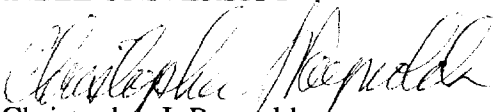
RAS bands are very damaging. The Observatory has refrained from proposing specific number for harmful power levels because many bands have already been affected by out-of-band emissions, which must be grandfathered. It appears unreasonable to apply strict standards to new services if existing services already severely damage the band. Puerto Rico will never be a "quiet zone" and the Arecibo staff has no illusions about this issue.

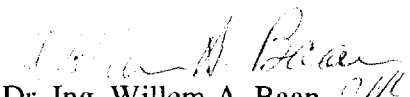
17. The Observatory considers technical solution for interference problems an important avenue for resolving interference. Filtering and modification of the beam pattern may help to reduce fundamental and harmonic power reaching the Observatory. The Observatory may also consider solution with a broadcaster operating from 7 am till 12 pm and being totally off the air during the remaining hours. The Observatory can then schedule specific observations in that band during a particular time of the year. The Observatory does not seek to use all frequencies at all times and the time sharing option certainly fits within the spirit of cooperation and coexistence.

Conclusion

For the foregoing reasons, the Comments filed in opposition to Cornell's Petition should be denied, except insofar as Cornell has modified its original proposal. In all other respects, the Petition for Rulemaking filed by Cornell should be granted.

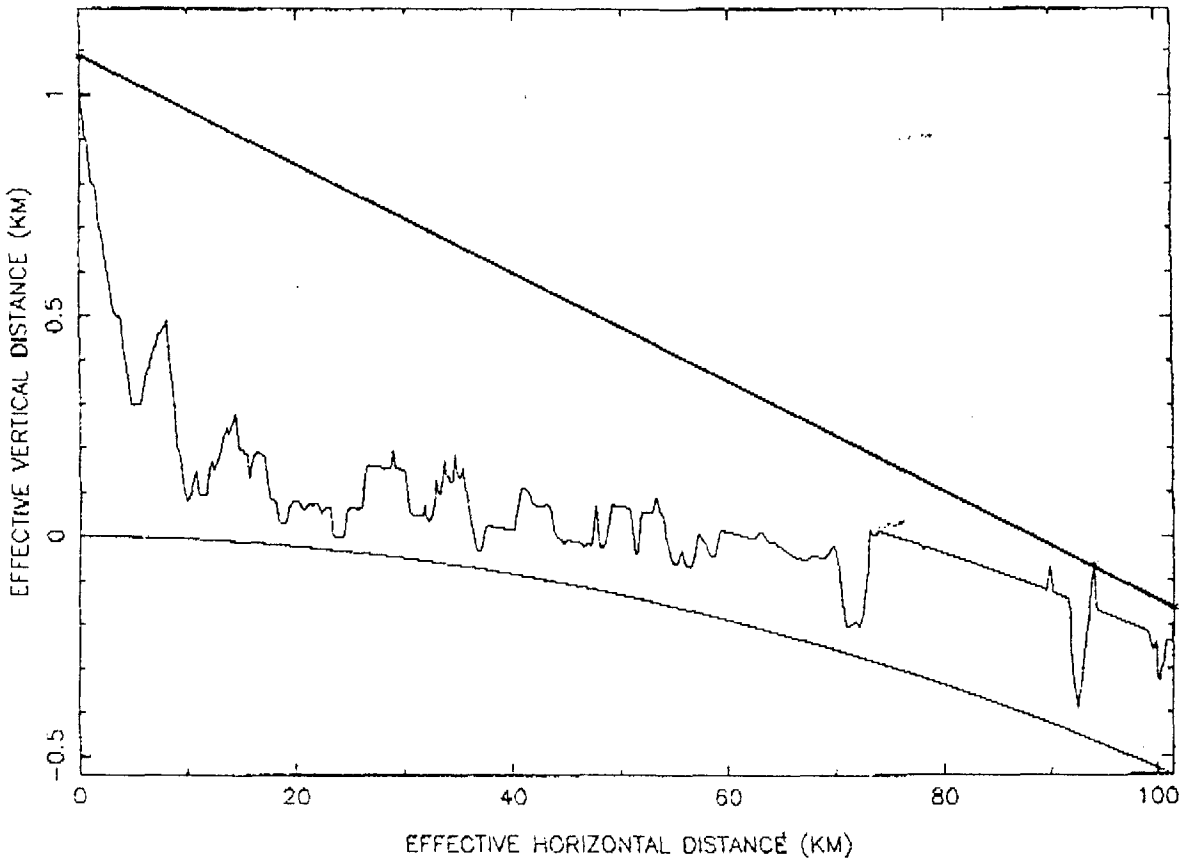
Respectfully submitted,
CORNELL UNIVERSITY

By: 
Christopher J. Reynolds
Its Attorney
Post Office Box 2809
Prince Frederick, MD 20678
(410) 535-9220

By: 
Dr. Ing. Willem A. Baan
Senior Research Associate and
Frequency Manager
Arecibo Observatory
Post Office Box 995
Arecibo, Puerto Rico 00613

March 4, 1993

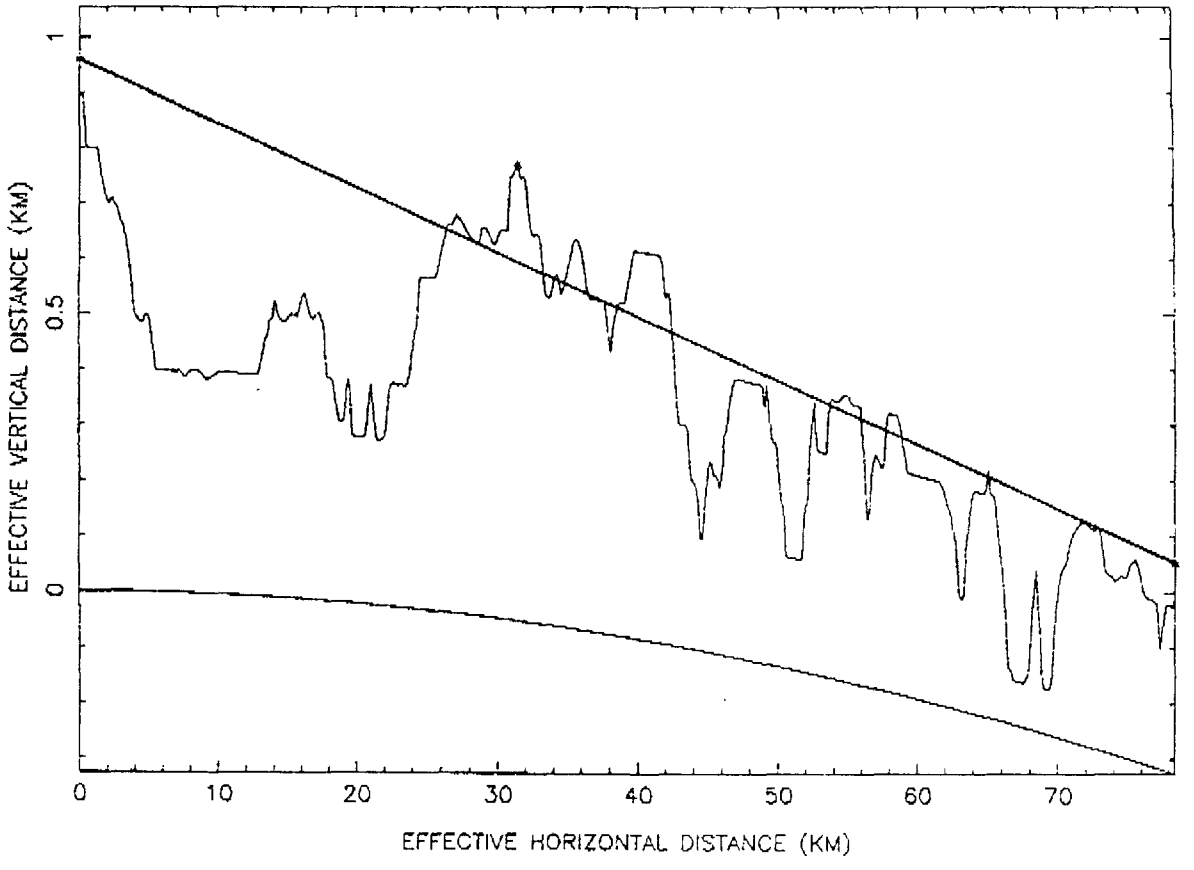
**TERRAIN PROFILES FROM EXISTING TRANSMITTER SITES TOWARD ARECIBO OBSERVATORY**




Terrain profile from transmitter site used by 3 of 5 Part 73 FM and TV facilities licensed to Fajardo, Puerto Rico.

FIGURE 1A

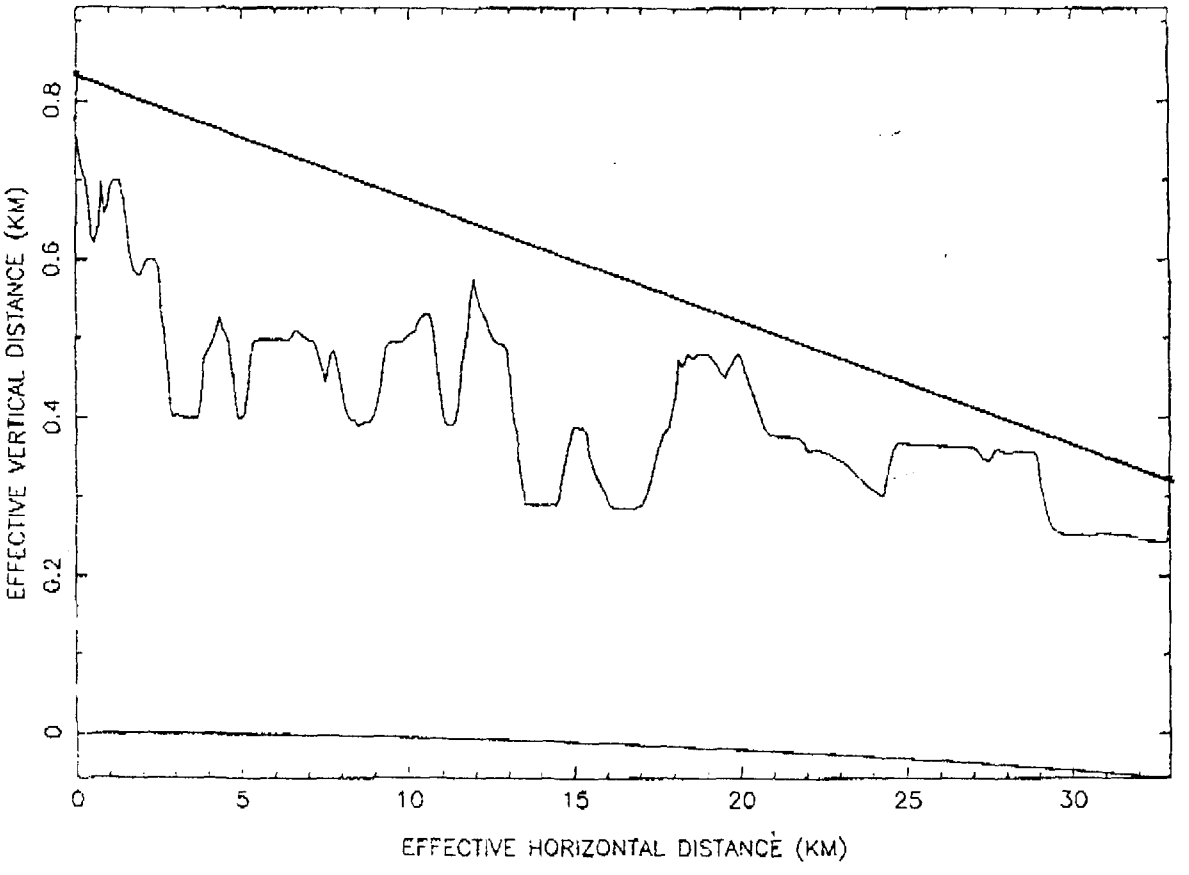
TERRAIN PROFILES FROM EXISTING TRANSMITTER SITES
TOWARD ARECIBO OBSERVATORY




Terrain profile from transmitter site used by 2 of 3 Part 73 FM and TV facilities licensed to Guayama, Puerto Rico.

FIGURE 1B

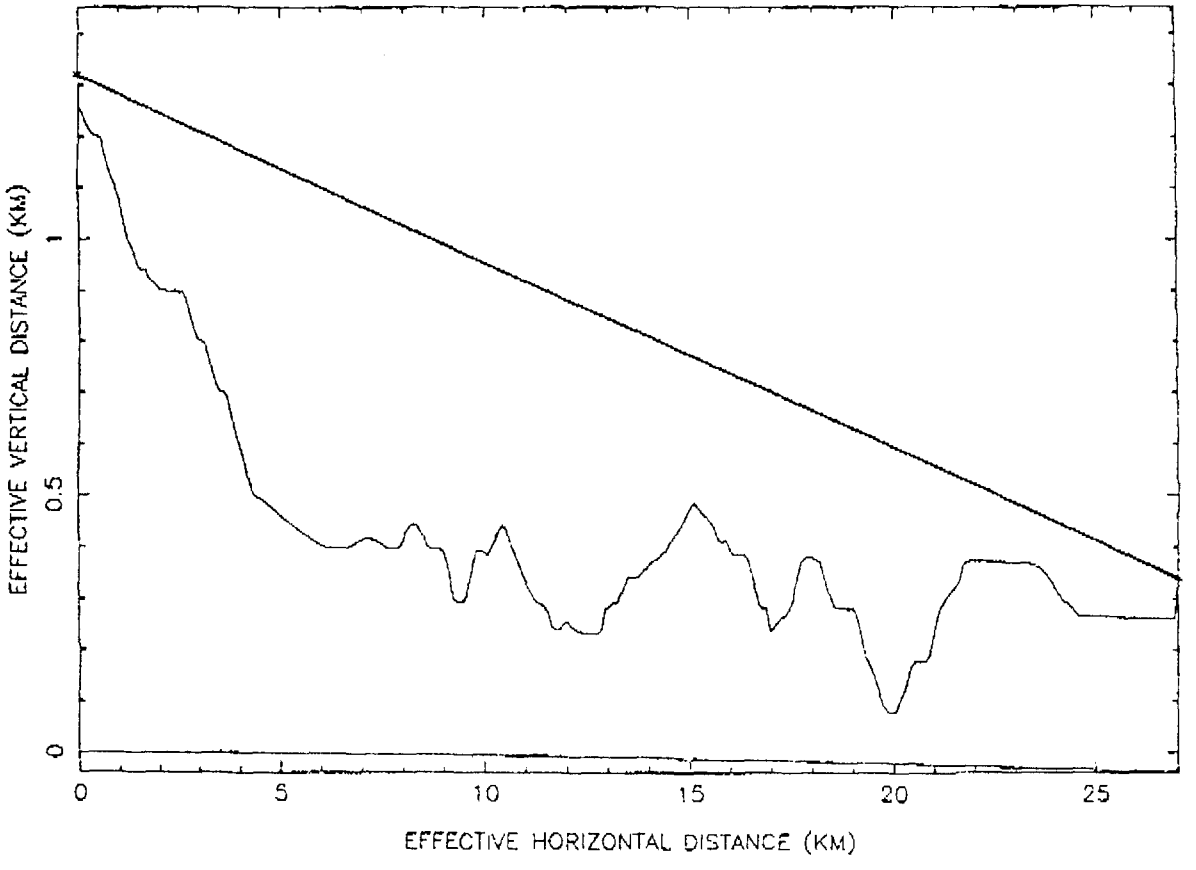
TERRAIN PROFILES FROM EXISTING TRANSMITTER SITES
TOWARD ARECIBO OBSERVATORY




Terrain profile from transmitter site used by 5 of 8 Part 73 FM and TV facilities licensed to Mayaguez, Puerto Rico.

FIGURE 1C

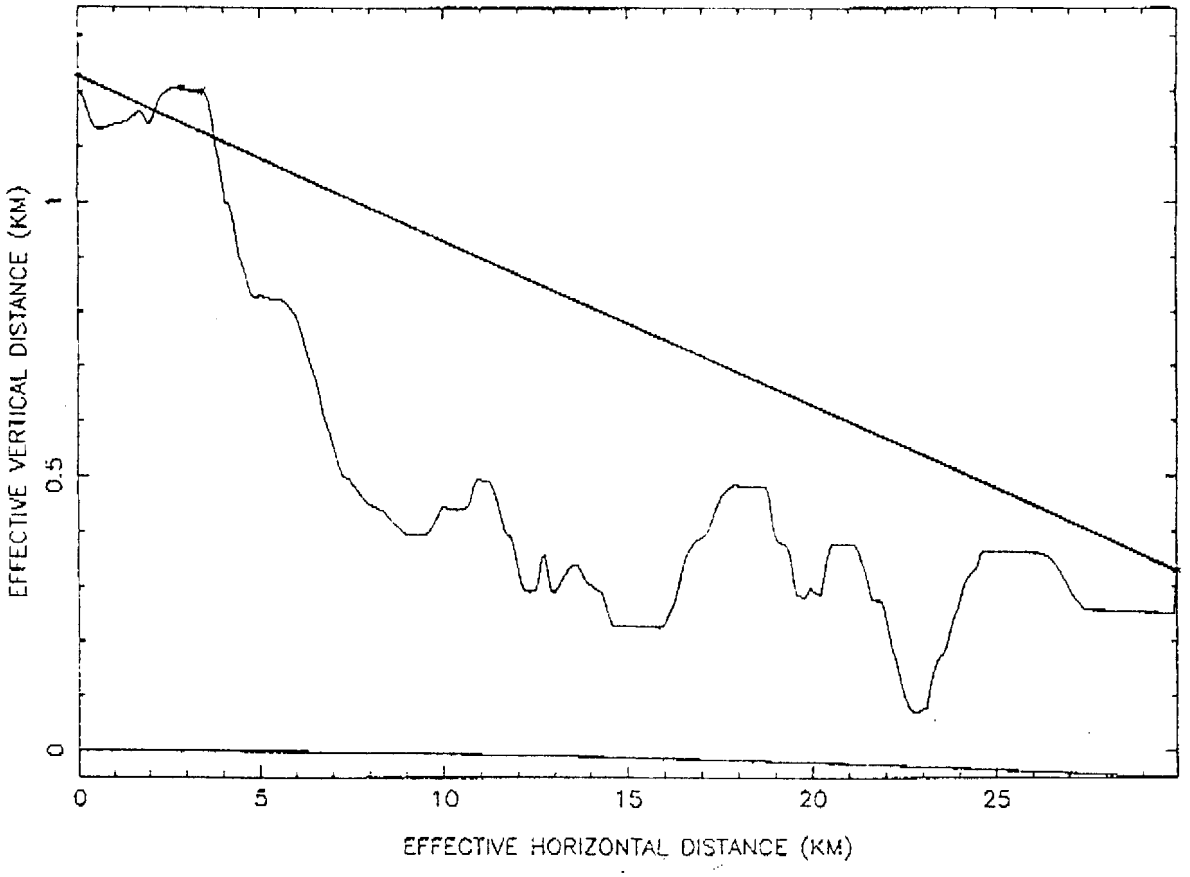
TERRAIN PROFILES FROM EXISTING TRANSMITTER SITES
TOWARD ARECIBO OBSERVATORY




Terrain profile from transmitter site used by 2 of 7 Part 73 FM and TV facilities licensed to Ponce, Puerto Rico.

FIGURE 1D

TERRAIN PROFILES FROM EXISTING TRANSMITTER SITES
TOWARD ARECIBO OBSERVATORY




Terrain profile from transmitter site used by 2 of 7 Part 73 FM and TV facilities licensed to Ponce, Puerto Rico.

FIGURE 1E

## CERTIFICATE OF SERVICE

I, Mima S. Shanor, a secretary in the law offices of Christopher J. Reynolds, hereby certify on this 4th day of March, 1993, that copies of the foregoing "Reply to Comments" were deposited with the United States Postal Service, postage prepaid, addressed to the following:

Christopher D. Imlay, Esq.
Booth, Freret & Imlay
1233 20th Street, N.W., Suite 204
Washington, D.C. 20036
Counsel for the American Radio Relay League, Inc. and the Society of Broadcast Engineers, Inc.

Julian P. Freret, Esq.
Booth, Freret & Imlay
1233 20th Street, N.W., Suite 204
Washington, D.C. 20036
Counsel for South Puerto Rico Broadcasting Corporation, WAEL, Inc., Abacoa Radio Corporation and Radio Aeropuerto, Inc.

Mima S. Shanor